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HAMILTON-WENTWORTH

PLANNING AND DEVELOPMENT DEPARTMENT

SETTLEMENT CAPABILITY STUDY FOR THE WOODBURN AREA

Underwood McLellan Ltd.

the umg group

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Underwood McLellan Ltd.

89 Carlingview Drive
Rexdale (Toronto), Ontario M9W 5E4
Telephone (416) 675-6484

July 16, 1980 File #1931-020

Mr. Joachim L. Schwarz, M.C.I.P.
Senior Planner
Regional Planning Division
Regional Municipality of Hamilton-Wentworth
100 Main Street East
Hamilton, Ontario
L8N 1G8

Dear Mr. Schwarz,

Re: Woodburn

We are pleased to submit 50 copies of the final report and plan completed in accordance with the project's terms of reference.

It has been concluded that Woodburn should not be extensively developed due to the presence of a shallow water table, very low soil permeability rates and the extensive amount of land within the flood areas of Twenty Mile Creek.

We trust you will find this submission to be satisfactory.

Yours very truly,

UNDERWOOD McLELLAN LTD.

Karl Reichert, P. Eng.,
Director, Environmental Engineering &
Assistant Branch Manager

KR:sd
Encl.

REGION OF HAMILTON-WENTWORTH

PLANNING AND DEVELOPMENT DEPARTMENT

OFFICIAL PLAN DIVISION

"SETTLEMENT CAPABILITY STUDY"

FOR THE

WOODBURN AREA

UNDERWOOD McLELLAN LTD.

JULY 1980

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1.0 INTRODUCTION

The Regional Municipality of Hamilton-Wentworth has identified the need for additional rural development. In 1975 and 1976, twenty-eight settlement areas in the Region were evaluated to determine general terrain conditions, means of water supply and methods of sewage disposal. That preliminary study, completed by Underwood McLellan Ltd., established a potential development population for each settlement based on the provision of available water and the suitability of the soils for private on-site sewage disposal facilities.

In 1979, the Region indicated that two of the original twenty-eight study areas, Freelton and Woodburn, were to be the subjects of a more detailed assessment to determine if more residential development could be permitted and where it should be allowed in each of these villages. The following report examines the development capability of Woodburn. The terms of reference for this study are included in Appendix A.

2.0 Purpose

The purpose of the study is to determine the ultimate size of development which could safely be supported in Woodburn on the basis of individual private wells and septic tanks and tile field disposal systems. Communal wells and other economically and environmentally acceptable sewage disposal systems, or a combination of these are an alternative consideration for supporting any future development.

3.0 LOCATION

The study area surrounding the village of Woodburn is located in the Township of Glanbrook (formerly the Township of Binbrook) in the Region of Hamilton-Wentworth. Located 1 3/4 miles south of Highway 20, the settlement is centred along Regional Road 34, Woodburn Road. The study area comprises Parts of Lots 3-5, Block 1, Concession 1 and 2, and Parts of Lots 1-3, Block 2, Concession 1 and 2, Township of Glanbrook.

The limits of the study area were selected to include a significant area of land around the intersection of Golf Club Road and Woodburn Road which was chosen as the centroid of the community.

4.0 FIELD PROGRAM

Once the boundaries of the study area had been established, the lands were analyzed by air photo interpretation in conjunction with soils and agricultural base maps to establish the various land units represented in and around Woodburn. Test holes were located and drilled to determine the soil and groundwater characteristics of the lands under investigation. Their locations are shown on Figure 1.

An introductory letter from the Region of Hamilton-Wentworth explaining the study was mailed to each of the land owners on February 15, 1980 where a test hole was proposed to be located. Copies of this letter and the accompanying permission forms are contained in Appendix B. A questionnaire was prepared to obtain information on the water supply and waste disposal systems currently in use by representative property owners. Where no residence was situated on the property, neighbours were contacted. Door to door interviews were conducted between March 18, 1980 and March 26, 1980. Interviews were carried out during the day hours and many have been followed up by telephone

4.0 FIELD PROGRAM (con't)

conversations. The people were aware of the project and were quite receptive to providing as much information as possible. Although none of the original driller's logs were available, the residents were generally able to complete the rest of the questionnaire without problems. A summary of the questionnaire findings are contained in Table 1 of this report.

Water samples were taken from three of the households during the water supply and sewage disposal survey. This limited amount of sampling was conducted to obtain only an approximation of the range in water quality. More extensive sampling was not considered to be necessary. All the water samples were obtained from the well via either a kitchen or work room tap. The findings of the Region's laboratory regarding its bacterialogical examination and chemical analyses of the water samples are given in Table 2.

The Trow Group Ltd. of Hamilton, a soils consulting and testing firm, was retained to drill seven test holes. On March 27, 1980, using continuous flight auger equipment, the borings were advanced to bedrock or 20 feet (6.1 metres) whichever occurred first. Representative samples were recovered at regular intervals for the purpose of subsoil identification. Soil types for each test hole were logged as were the water table locations if encountered. In addition, standpipes were installed in each boring to enable measurement of a "stabilized" water level at a later date.

A 4-foot (1.2 metre) percolation test hole was put down adjacent to each soil boring. Due to the extremely wet ground conditions, percolation tests had to be postponed until mid-April 1980. The positioning of the test holes was generally intended to reflect the character of the different area soils for tile field installations. The corresponding test hole records and percolation test results are contained in the Trow Group Ltd. report in Appendix C.

TABLE 1

SUMMARY OF WOODBURN

WATER SUPPLY AND WASTE DISPOSAL SURVEY

SECTION	PERSON CONTACTED AND PROPERTY LOCTION IN TOWNSHIP OF GLANBROOK			
A) Water Supply	R. Mitchell Block 2 Conc. 2 Lot 2	N. Kirby Block 2 Conc. 2 Lot 1	B. Ridge Block 1 Conc. 2 Lot 5	S. Legato (Binbrook Golf Club) Block 1 Conc. 2 Lot 3
Date of Survey	March 18, 1980	March 18, 1980	March 18, 1980	March 26, 1980
Driller's Log	---	---	---	---
Type of Well	Drilled (1)	Drilled	1) 1 drilled 2) 1 drilled 3) 1 hand-dug	Drilled
Depth of Well	25'(7.625 m)	27' (8.235 m)	1) By house 35'(1) (10.675 m) 2) By barn 27'-28' (8.4 m) 3) By house 28' (8.54 m)	28'-35' (8.54 m - 10.675 m)
Depth of Casing	29' (8.845 m)	27' (8.235 m)	---	35' (10.675 m)
Location of Screen (if any)	No	No	No	No
Diameter of Well	6" (.153 m)	6" (.153 m)	1 and 2 6" (.153 m) 3 4' (1.22 m)	6" (.153 m)
Aquifer Type and Depth	Limestone 0025	Clay	---	---
Static Water Level	10'-12' (3.05 m - 3.66 m)	13'-14' (3.965 m - 4.27 m)	1) 15' (4.575 m) 2) 15' (4.575 m) 3) 15' (4.575 m)	4' (1.22 m)
Pumping Water Level	Negligible change	Negligible change	---	4' (1.22 m)

TABLE 1 (con't)

SECTION	PERSONS CONTACTED			
A) Water Supply (con't)	R. Mitchell	N. Kirby	B. Ridge	S. Legato
Pumping Rate	6 GPM (27.3 LPM)	4 GPM (18.2 LPM)	---	50 GPM (227.3 LPM)
Quality of Water	Hard (2)	Hard (1)	Good (1)	Sulphur (1)
Other Coments	1. Inside original hand-dug well 2. Softener necessary Sulphur below 30' (9.15 m)	1. Softener necessary	1. Sulphur experienced at depths greater than 30' (9.15 m)	1. Chlorinator and softener necessary Has holding tank

SECTION	PERSONS CONTACTED			
B) Waste Disposal	R. Mitchell	N. Kirby	B. Ridge	S. Legato
Type of Waste Disposal	Below grade field	Below grade field	2 below grade fields	Lagoon
No. of House Occupants	6	2	2 on each system	2 (800 person capacity)
Frequency of Maintenance	1 pump out a year	Pump out every 3-4 years	Never for north system 1 pump out every 3-4 years for south system	None
Problems	None	None	None	None

TABLE 2

SUMMARY OF BACTERIALOGICAL EXAMINATION

AND CHEMICAL ANALYSIS OF WATER SAMPLES

WOODBURN STUDY AREA

	HOUSEHOLD SURVEYED		
Parameter	R. Mitchell Block 2 Conc. 2 Lot 2	B. Ridge Block 1 Conc. 2 Lot 5	S. Legato Binbrook Golf Club, Block 1 Conc. 2 Lot 3
Total Coliform/100 ml.	182	46	0
Fecal Coliform/100 ml.	0	13	0
Ammonia (ppm)	0.04	0.02	0.17
Nitrates (ppm)	2.6	2.3	ND
Sulphates (ppm)	31	185	930
Iron (ppm)	10	<.05	1.8
pH	7.4	7.4	7.2
Chloride (ppm)	16	4	5
Total Hardness (ppm)	700	700	533
Alkalinity (ppm)	356	408	359
Total Dissolved Solids (ppm)	466	1046	1797
Sulphur (ppm)	ND	ND	ND

NOTE: ND = Not Detected

5.0 GENERAL DISCUSSION

5.1 Bedrock

From existing information, the bedrock within the Woodburn Study Area is a dolomitic limestone. The depth to the bedrock from ground surface appears to generally be greater than 20 feet (6.1 metres).

5.2 Soils

The primary soil type in the area is a clay till which is overlain by clay in the vicinity of Twenty Mile Creek. The interpreted extent of the till and clay are shown on Figure 1.

5.3 Topography

The topography of the Woodburn Study Area is flat-lying, with slopes generally less than 10% as illustrated on Figure 1.

5.4 Surficial Drainage

Poor internal soil drainage and the generally flat-lying topography, results in a high water table and surface ponding of water during heavy precipitation and spring run-off periods. Extensive areas adjacent to Twenty Mile Creek are also subject to flooding during these periods as illustrated by the draft floodline and the many surface drainage features plotted on Figure 1.

5.5 Groundwater

During the spring run-off and other extremely wet periods of the year a perched water table in the overburden soils can be expected with the water table levels near the ground surface over most of the area. The test drilling program associated with this study was carried out in mid-April 1980 and a high perched water table was recorded. During drier periods of the year this water table would be somewhat lower. However, due to the poor internal drainage of the soil, this water table may not vary significantly even during the drier time of the year.

The majority of homes in the area obtain their water supply from the limestone bedrock aquifer. The wells in the area are founded in and obtain water from the fractured limestone bedrock at depths ranging from 20 to 50 feet (6.1 to 15.25 metres) below ground surface. Water is generally found at the surface to within 10 to 15 feet (3.0 to 4.5 metres) of the surface of the fractured limestone bedrock. The static water level in the bedrock most often rises above the bedrock surface to within 10 to 20 feet (3.0 to 6.1 metres) of ground surface.

Existing water well data contained in Appendix D indicates that the aquifer yield potential of 10 to 20 gpm for individual wells is good. The potential for yields up to 50 gpm is only fair.

Two of the sampled well waters contained coliform bacteria, one of which also included fecal coliform bacteria. These wells should be disinfected with "Javex" or similar chlorine solution, pumped out and retested to confirm the water quality. Should this contamination condition persist, then the well(s) should be inspected to determine if surface water is gaining access or the well(s) should be replaced with a new one.

5.5 Groundwater (con't)

The nitrate, chloride, and ammonia contents are adequately low.

Iron concentration greater than 0.3 ppm causes iron staining and could promote iron bacteria growth which would affect the aesthetic quality of the water. One well had a very high iron content of 10 ppm. However, this is not a public health concern.

The hardness, alkalinity and total solids contents are high in two of the tested well waters. However, these levels are not considered to be sufficiently excessive and the only effect is that the water requires larger amounts of detergents or soap when washing.

The sulphate content of 930 ppm in one of the well waters exceeds the recommended maximum of 250 ppm. Drinking water supplies with a sulphate content greater than this level can cause a laxative effect to persons, particularly infrequent users. Although, persons using such a water supply on a regular basis can become acclimatized to the water, such a water supply should not be used in public places. The removal of sulphates from a water supply is very difficult and costly. Accordingly, where such a situation exists it is normally recommended that the well be sealed and a new supply obtained.

Although no hydrogen sulphide was detected in the tested water samples, there have been reports of hydrogen sulphide being present in some of the wells in Woodburn. When hydrogen sulphide is present in a water supply, it is aesthetically very objectionable, but can be readily removed through simple aeration.

5.5 Groundwater (con't)

Generally, it may be concluded that quite a wide range in ground water quality exists in Woodburn and the quality that would be obtained from a new well is not predictable.

5.6 Alternative Methods of Sewage Disposal

Alternative methods of sewage disposal have been considered, as discussed in Appendix E.

Due to the presence of a high watertable, and the low permeability of the native soils, extensive development in Woodburn is not recommended. Imported fill could be placed to create suitable areas for tile fields. Such installations should be sufficiently large to achieve percolation of the sewage into the underlying native soils. Alternatively, in areas where the water table is greater than 10 feet from the ground surface, the tile field should be constructed as a normal trench system in the native soils. The alterntive type of tile field which incorporates storage of the sewage over the fall, winter and spring months and evapotranspiration during the growing season has been considered and rejected.

Generally, the Ontario climate is not suitable for the operation of a evapotranspiration type system due to the amount of precipitation that occurs. This option was accordingly rejected.

6.0 CONCLUSIONS

A perched watertable exists in the clays and clay tills of the Woodburn Study Area, which is often at or near the ground surface. The permeability of these soils are approximately 10^{-7} cm/sec.

In most cases, the water chemistry is adequate for human consumption, but has the inconveniences of high hardness, iron and sulphate levels. On occasion these are accompanied by a hydrogen sulphide odour. In some instances, poor water quality within the study area has caused residents to have water delivered to their homes. Water containing sulphates in excess of 250 ppm can cause laxative effects, and is not recommended for human consumption. Contamination of well water, as evidenced by the presence of coliform bacteria is occurring in existing wells and should be corrected.

The above factors combined with the flooding characteristics of Twenty Mile Creek are the basis for the conclusion that extensive additional development of Woodburn should not be considered. However, some limited individual new developent or upgrading of existing developent could be considered for those areas located above the Twenty Mile Creek (draft) Regional floodline.

The tile field size and lot area required for a single family residence is as follows:

Daily Sewage Flow Design	300 gpd (1,360 Lpd)
Lineal Feet of Tile in Single Field	4,000 ft. (1,200 m)
Area for Single Field including 10-foot Buffer	31,500 sq.ft. (3,076 sq.m)
Recommended Area including Stand-by	57,000 sq.ft. (5,566 sq.m)

6.0 CONCLUSIONS (con't)

Implied Minimum Lot Size	250 ft. x 350 ft. (76.2 m x 106.7 m)
Implied Lot Size	2 acres (0.81 ha.)

7.0 RECOMMENDATIONS

1. Individual private wells should continue to be utilized by existing and future residents. It must be recognized that not all residents will be successful in obtaining a water supply with acceptable chemical characteristics.

2. Individual private sewage disposal systems should be utilized for sewage disposal. In the case where the proposed lot is topographically high, relative to the location of the Twently Mile Creek floodline, a normal tile field could be installed if the lot has a minimum buildable area of 2 acres (0.81 ha.).

3. Development within the designated flood plain of Twenty Mile Creek should not be permitted.

4. Infilling with single family residences could be considered, but Woodburn does not have the water quality nor the soil and ground water conditions that are considered necessary for its designation as a growth area.

7.0 RECOMMENDATIONS (con't)

5. Commercial, industrial or institutional land uses should be located in other areas where the site conditions are more favourable for the provision of individual private water supplies and sewage disposal systems

Respectfully submitted,

Karl Reichert, P. Eng.
Director, Environmental Engineering &
Assistant Branch Manager

Michael Brown, B.E.S.
Planner

APPENDIX A

STUDY TERMS OF REFERENCE

THE REGIONAL MUNICIPALITY OF
HAMILTON
WENTWORTH

December 14,1979 File # R.555.3

Mr. Karl Reichart, P.Eng.,
Director
Environmental Engineering and
Assistant Branch Manager
89 Carlingview Drive
Rexdale, Ontario
M9W 5E4

Dear Karl:

SUBJECT: Settlement Capability Studies
for Woodburn and Freelton

This letter is to advise that on December 4,1979, Regional Council approved the recommendation to retain your firm to carry out the above noted studies.

You are hereby requested to commence the study and submit the details of the field work which require co-ordination with the local Municipal Councils and/or residents.

The Officials in the Area Municipalities of Glanbrook and Flamborough have been advised of the proposed studies and we will arrange the necessary meetings after receiving the details of the work program from your office.

Our solicitor will prepare the necessary agreement which will be forwarded to you in the near future.

Yours truly,

Mohammed Afsar, P.Eng.,
Senior Planner
Regional Planning Division.

MA;hk

Planning and Development Department.
100 Main St., East, Hamilton, Ont. L8N 1G8

November 20, 1979

Mr. M. Afsar, P. Eng.,
Senior Planner
Regional Planning Division
Regional Municipality of Hamilton-Wentworth
Planning and Development Department
100 Main Street East
Hamilton, Ontario
L8N 1G8

Dear Mr. Afsar,

Re: Settlement Capability Study for:
Woodburn - Township of Glanbrook
Freelton - Township of Flamborough

Further to our letters of October 26, 1979, and our discussions on November 12 and 15, 1979, we have reviewed the scope of work and costs to carry out assessements of Woodburn and Freelton for further settlement development.

The revised proposal follows:

Scope of Work

1. Obtain recent additional information on new water wells from the MOE, analyze this data together with the data now in our files to determine the probable safe groundwater yield in the Woodburn and Freelton areas. Prepare a tabulation of all this data.

2. Obtain recent additional information on development proposals and new septic tank systems from the Health Department.

3. Review other relevant background information that may be available from the Conservation Authority, the Agricultural representative relating to land drainage, flooding, etc., within the study area. Prepare a summary of all background data.

4. Conduct a door to door survey of a number of homes, to obtain information on present water table elevations, water supply reliability, water samples for bacterialogical examination and chemical analysis. It is anticipated that the samples would be analyzed by the Region's laboratory. Also obtain information on sewage disposal systems.

5. Utilizing well log information and available topographical plans of the area beyond the study area, determine the direction of groundwater flow and, if possible, the groundwater recharge area. It is important that the recharge areas close to the settlement be identified and protected from development that could affect the groundwater quality.

6. Retain a soils consulting and testing firm to construct a number of deep test holes to bedrock or 20 ft. which ever is greater. It is anticipated that approximately 12 holes would be put down in Woodburn and 6 holes in Freelton. Soil types for each test hole would be logged and also the water table location, if encountered. Due to expected soil type variability it will be necessary to enter on to private lands in Woodburn in order to place the test holes at representative locations. We would mark the test location on a plan and request that a Region of Hamilton-Wentworth representative contact the affected property owners to seek and obtain permission to enter on to the private property for soil testing. The resolution of access to the lands could be somewhat time consuming and impossible to judge when it could be completed. Accordingly, this proposal does not include the time associated with the securing of permission to enter on to the private lands.

7. Determine the susceptibility of ground and surface water to contamination from development located on the higher lands and along the existing watercourses. Assess the alternatives to protect these waters while permitting the development of the settlements. This aspect is particularly important in areas that may have a relatively shallow depth of overburden over the groundwater table or bedrock.

8. Determine the tile field requirements for different types of development, located in the different soils of the study area.

9. Determine the extent of development possible based on the use of individual groundwater or communal (Regionally owned) water supplies and on the identified aquifer potential.

10. Determine the minimum residential lot area that should be provided in the different near surface soil types, and provide recommendations on development density for residential development, and guidelines for commercial and industrial development, based on the sewage disposal system requirements.

11. Determine the ultimate development capability possible in the study area based on the use of individual private well water supplies and on communal or Regionally owned water systems. Prepare recommendations on the approach that should be followed during the construction of new housing to protect the tile field area from damage due to construction traffic.

12. Outline a monitoring program to determine when the development of an area is approaching its ultimate development capability.

13. Preparation of a report and plan for each settlement, review with the Client, amend and finalize, provide the Client with 50 copies of the report.

APPENDIX B

INTRODUCTORY LETTER FROM REGION OF HAMILTON-WENTWORTH

SIGNED PERMISSION FORMS

THE REGIONAL MUNICIPALITY OF
HAMILTON WENTWORTH

February 15,1980 File # R 555.3

Dear Property Owner:

On December 4,1979, Regional Council approved a study of the development capability of the Woodburn Settlement Area. The purpose of the study is to determine if any more residential development can be permitted in Woodburn and where it should be permitted.

The Region has retained Underwood McLellan (1977) Ltd., as a Consultant to conduct this study. As part of the research the Consultant must ascertain soil and ground water characteristics of the lands under investigation by drilling tests on various properties. This procedure will be undertaken at no cost to you.

By this letter we wish to request your permission to permit our Consultant to enter your property to undertake the required tests. We trust that you will grant this permission so that the study may proceed.

The Consultant has scheduled testing for the last two weeks of March 1980. Upon receipt of the attached permission form you will be notified of the precise date when tests will be performed on your property. These tests should not result in any damage to your property. However, if there is any cause for claims the Consultant is fully responsible.

We attach a prepaid envelope and permission form. Please sign the form and return to our office.

We wish to thank you in advance for your co-operation. Should you wish to have additional information please do not hesitate to contact myself or Mr. J.L. Schwarz of my department.(Tel. 526-4178).

Yours very truly,

D.A. Lychak, M.C.I.P.
Commissioner
Planning and Development

JSB;hk

Planning and Development Department.
100 Main St., East, Hamilton, Ont. L8N 1G8

RECEIVED MAR 5 1980

P E R M I S S I O N

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this day of 3- MARCH 1980..

Mario Crescenzi

RECEIVED FEB 20 1980

PERMISSION

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 19th day of February 1980.

Ivan Nitchke

I have note that I rent the here land from Mr. Veri and that damage to crop there would be compensate to me

R.M.

RECEIVED FEB 22 1980

PERMISSION

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 19th day of February 1980.

Louise A. Wan

RECEIVED FEB 22 1980

P E R M I S S I O N

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 18th day of February 1980.

NATIONAL TRUST COMPANY LIMITED

John C. M. Mayo

MANAGER

Agent for Mullin Kirby

RECEIVED FEB 27 1980

P E R M I S S I O N

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 20 day of Feb. 1980.

Blair Ridge

RECEIVED MAR 5 1980

P E R M I S S I O N

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this [illegible] day of [illegible] 1980.

[illegible]

APPENDIX C

THE TROW GROUP LIMITED REPORT
PRELIMINARY GEOTECHNICAL INVESTIGSATION
AND
SEPTIC SUITABILITY STUDY
WOODBURN, ONTARIO

The Trow Group Limited

CONSULTING
ENGINEERS

HAMILTON BRANCH
P.O. BOX 430, STN. B, HAMILTON, ONTARIO, L8L 7W2
TELEPHONE (416) 560-3001

Project: H3290-G

April 24, 1980

Underwood McLellan Ltd.
c/o UMA Group
89 Carlingview Drive
Rexdale, Ontario
M9W 5E4

Attention: Mr. C. Anderson

Preliminary Geotechnical Investigation
and Septic Suitability Study
Woodburn, Ontario

Dear Sir,

The Trow Group Limited was retained to conduct a preliminary geotechnical investigation at the above noted site. The objective of this investigation was to present a general overview of the subsoil and ground water conditions prevailing at the site and comment generally on the suitability of these subsoils for sewage disposal using septic tile methods.

Seven (7) exploratory borings were put down at locations selected by a representative of Underwood McLellan Ltd. These borings were advanced to a maximum depth of 6.1 m (20 feet) on March 27, 1980 by Longyear Canada Incorporated under the direction and supervision of a representative of The Trow Group Limited. Representative samples were recovered at regular intervals for the purpose of subsoil identification and subsequent laboratory testing, if required, at a later date. In addition, a percolation test hole was put down adjacent to each boring as per the enclosed Drawing No. 2. An additional boring, originally designated as Borehole 1 had been specified, but could not be drilled due to severe access problems caused by overly wet conditions.

Observations of the ground water were conducted in the open borings during the course of the fieldwork. In addition, standpipes were installed in each boring to enable measurement of a "stabilized" water level at a later date.

The borehole locations have been established by The UMA Group and are indicated on the enclosed Drawing 1.

SUBSOIL CONDITIONS

A review of published pedological studies for this area indicates that the subsoils in this area consists primarily of silty clays and clay tills associated with the Beverly and Binbrook series common to the eastern portions of the Wentworth County. The soils are moderately stone free and generally poor draining.

The borings put down at the site confirm this information. All of the borings encountered deposits of brown silty clay with occasional fine gravels. A relatively thin deposit of clayey silt till was also proven in one of the borings, Borehole 5, underlying this silty clay stratum. Refusal to augers was noted at fairly shallow depths in a number of the borings and was assumed to be the top of bedrock. Details of the subsoil are given on the Borehole Logs, Drawings 3 through 9.

The ground water levels were recorded several days after standpipe installation and are shown on the attached borehole logs and the attached Drawing No. 2.

SEPTIC TILE SUITABILITY

Percolation tests were conducted between April 19 and 20, 1980 following the method specified by the Ontario Ministry of the Environment. In addition, all of the test holes were well saturated beyond the minimum recommended by the Ministry of the Environment as it had rained at the site over several days prior to testing. In addition, water was added to each test hole on a practically continuous basis for at least 48 hours before the tests were performed.

The results of the percolation tests are presented on Table No. 1, attached.

As can be seen from Table 1, it is obvious that the rate of water fall in all of the borings was extremely slow. This is assumed to be due in part to the impermeable nature of the subsoils encountered at this site, and the high water table noted in all of the test locations, i.e., the ground was extremely wet within 1 or 2 feet of the existing ground surface. The percolation rate for these locations, expressed as "t" values, is expected to be of the order of hundreds of minutes. As such, septic tile beds designed for the proposed subdivision will be required to be placed on raised beds, as recommended by the Ontario Ministry of the Environment.

We trust that this information is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours very truly,
THE TROW GROUP LIMITED

M. H. MacKay, P. Eng.

D. Schebesch, P. Eng.

MHM/ml
Encl.
Dist: Underwood McLellan Ltd.
c/o UMA Group (2)

Project: H3290-G

TABLE 1
PERCOLATION TEST RESULTS
WOODBURN, ONTARIO

TEST HOLE NO.	DATE (1980)	TIME	DEPTH TO WATER LEVEL
1	April 19	2:10 pm	12-11/16"
		4:58 pm	12-7/8"
	April 20	10:37 am	13-3/8"
		1:55 pm	13-1/2"
2	April 19	2:45 pm	18-5/16"
		6:00 pm	18-1/4"
	April 20	10:45 am	18-1/4"
		2:10 pm	18-3/8"
3	April 19	2:20 pm	22-1/2"
		5:37 pm	22-1/2"
	April 20	11:02 am	22-1/2"
		2:41 pm	22-1/2"
4	April 19	3:00 pm	13-3/4"
		5:48 pm	13-7/8"
	April 20	10:41 am	14-7/8"
		2:02 pm	15-3/8"
5	April 19	2:30 pm	17"
		5:27 pm	17-1/4"
	April 20	11:05 am	19-1/4"
		2:53 pm	19-5/8"
6	April 19	2:00 pm	14-1/16"
		5:17 pm	14-3/4"
	April 20	10:52 am	14-1/4"
		2:26 pm	14-1/4"
7	April 19	2:40 pm	18-1/4"
		5:09 pm	18-5/8"
	April 20	11:13 am	19-7/8"
		3:08 pm	20" even

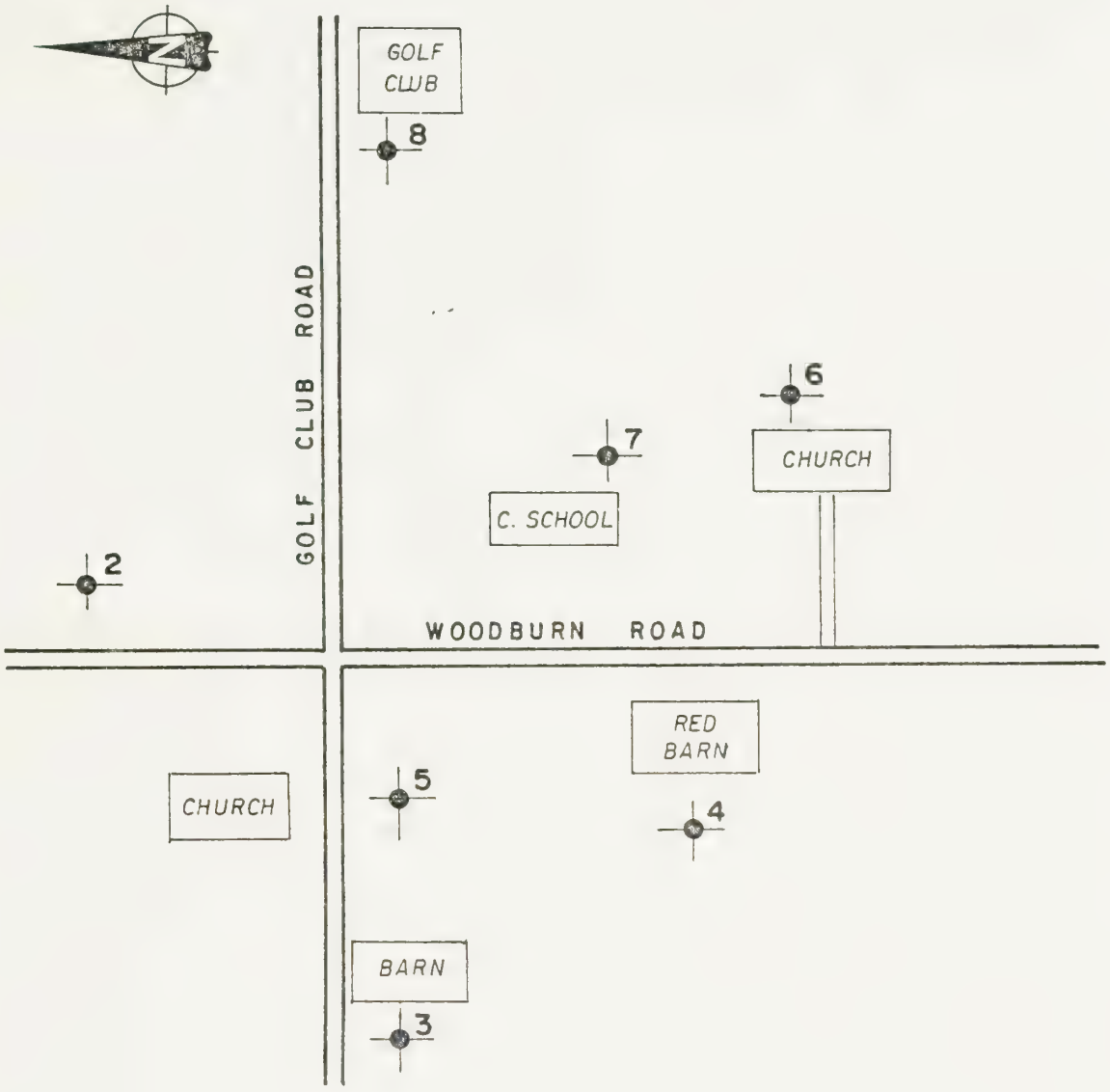
NOTES:

Slight rain during night may have affected readings slightly.

All readings made to top of perforated pipe.

PROJECT NO. H3290-G

DRAWING NO. 1



LEGEND

BOREHOLE

NOT TO SCALE

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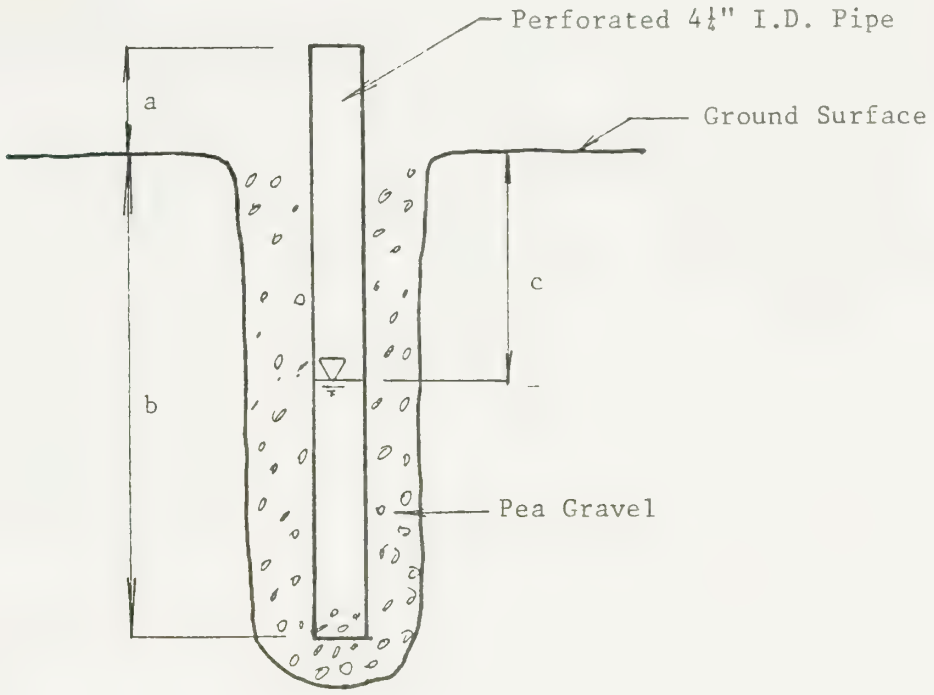

Percolation Test Hole No.	Dimension			
	a	b	c	
1	8"	4'4"	1'5"	
2	8-3/4"	4'4½"	1'1¼"	
3	12-1/4"	4'0¼"	0'7"	
4	10-1/4"	4'0½"	0'9$\frac{1}{8}$"	
5	10-3/4"	4'0¼"	1'11"	
6	8"	4'6"	1'5"	
7	11"	4'1"	1'3"	

BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 1 DRAWING No. 3

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST + S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		60 cm TOPSOIL & organic material		0
		SILTY CLAY-brown becoming grey trace of organic stainings, occ. fine gravel, stiff, moist		1
				2
				3
				4
				5
				6
				7
				8
				9
				10
		TERMINATED		

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT kN/m³

NOTES:

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	dry	6.1
April 16/80	0.5	---

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BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 2 DRAWING No. 4

PROJECT Proposed Subdivision

LOCATION Woodburn, Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE ⊠
SPT (N) VALUE ○ ○
DYNAMIC CONE TEST ——
SHELBY TUBE ● ●
FIELD VANE TEST + S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT ⊢—○
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 15 ⊕ 5
% STRAIN AT FAILURE 10
PENETROMETER ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		45 cm of organic soil & plant material, FIELD in FALLOW		0
		SILTY CLAY-brown becoming grey with increased depth, trace of sand in thin seams or partings, occ. fine gravel, moist to wet		1
				2
				3
				4
				5
		REFUSAL TO AUGERS ON ASSUMED BEDROCK SURFACE		6
				7
				8
				9
				10

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

NOTES:

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	dry	5.48
April 16/80	0.23	---

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BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 3 DRAWING No. 5

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST +S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH
		60 cm TOPSOIL & ORGANIC MATERIAL rootlets, plant fibre, etc.		0
		SILTY CLAY-light brown to grey, trace of sand and fine gravel, stiff, moist to wet		1
				2
				3
				4
				5
		REFUSAL TO AUGERS ON ASSUMED BEDROCK SURFACE		6
				7
				8
				9
				10

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

NOTES

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	dry	5.8
April 16/80	surface	---

BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 4 DRAWING No. 6

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST
LAB VANE TEST

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH	N VALUE (ASTM D1586-CSA A119.1) 20 40 60 80 SHEAR STRENGTH MPa	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS (DRY WEIGHT) 10 20 30	NATURAL UNIT WEIGHT kN/m³
		45 cm TOPSOIL & ORGANICS, rootlets, plant fibres (FIELD IN FALLOW)		0			
		SILTY CLAY-light brown to grey, occ. sand in upper zones, trace of fine gravel, stiff, moist to wet		1			
				2			
				3			
		CLAYEY SILT TILL-grey, fine to med. gravel, shale fragments, dense, moist		4			
		REFUSAL TO AUGERS ON ASSUMED BEDROCK SURFACE		5			
				6			
				7			
				8			
				9			
				10			

NOTES

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	3.8	4.6
April 16/80	surface	---

BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 5 DRAWING No. 7

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST + S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		45 cm TOPSOIL & ORGANIC MATERIAL plant, fibres, rootlets, etc.		0
		SILTY CLAY TO CLAYEY SILT- brown, grey to grey, till-like with increased depth, fine to medium gravel, trace of sand in upper levels, compact to dense, moist to wet		1
				2
				3
				4
				5
				6
				7
				8
				9
				10
		TERMINATED		

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS : DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

NOTES

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 26, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	dry	6.1
Apr.16/80	0.64	---

BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 6 DRAWING No. 8

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST
LAB VANE TEST

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH
		60 cm TOPSOIL & organic material		0
		SILTY CLAY-brown becoming grey trace of organic stainings, occ. fine gravel, stiff, moist		1
				2
				3
				4
				5
				6
				7
				8
				9
				10

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

TERMINATED

NOTES:

1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	wet cave	4.9
April 16/80	0.25	---

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BOREHOLE LOG

JOB No. H3290-G BOREHOLE No. 7 DRAWING No. 9

PROJECT Proposed Subdivision
LOCATION Woodburn
Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST +S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		GOLF COURSE		0
		60 cm TOPSOIL with organic stained soil		
		SILTY CLAY-brown becoming grey, occ. fine gravel, slightly sandy in seams, stiff becoming soft with depth, moist to wet		1
				2
				3
				4
				5
				6
		TERMINATED		7
		NOTES:		8
		1. Borehole advanced uncased using continuous flight auger equipment by Longyear Canada Incorporated on March 27, 1980.		9
		2. Water Level Records		10

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	dry	6.1
April 16/80	0.4	---

N VALUE (ASTM D1586-CSA A119.1)
SHEAR STRENGTH MPa
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS DRY WEIGHT
10 20 30
NATURAL UNIT WEIGHT t/m³

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APPENDIX D

SUMMARY DESCRIPTION OF EXISTING WELLS - WOODBURN

APPENDIX 'D'

SUMMARY DESCRIPTION OF EXISTING WELLS - WOODBURN STUDY AREA

TOWNSHIP OF GLANBROOK

REGION OF HAMILTON-WENTWORTH

WELL NO.	LOCATION BLOCK I CONC	LOT	STATIC WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
1	1	3	32	12	30	3	Tpsl	0005	
							Brwn clay	0015	
							Blue clay	0021	
							Lmsn	0035	
2	1	4	40	5	20	20	Tpsl	0001	
							Brwn clay	0015	
							Clay bldr	0034	
							Lmsn	0041	
3	1	4	30	10	30	4	Clay	0021	
							Lmsn	0035	
4	1	4	40	10	20	10	Brwn clay	0004	
							Blue clay bldr	0030	
							Lmsn	0045	
5	1	5	32	8	18	10	Brwn clay	0009	
							Blue clay	0018	
							Lmsn	0045	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
6	1	5	33	12	12	17	Clay	0018	
							Bldr	0020	
							Lmsn	0030	
7	1	5	32	15	20	10	Tpsl	0001	
							Brwn clay	0016	
							Grey clay	0029	
							Lmsn	0032	
8	1	5	33	18	20	17	Clay	0023	
							Lmsn	0033	
9	1	5	32	8	17	10	Brwn clay	0010	
							Blue clay	0018	
							Lmsn	0032	
10	1	5	28	10	20	5	Clay	0015	
							Shle	0020	
							Grvl	0026	
							Grey lmsn	0030	
11	1	5	23	9	20	9	Brwn clay	0010	
							Grey clay	0014	
							Grey lmsn	0024	
12	1	5	22	10	20	2	Blue clay	0018	
							Lmsn	0030	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
13	1	5	26	10	26	7	Tpsl	0004	
							Blue clay	0025	
							Shle	0026	
14	1	5	33	16	25	12	Clay	0027	
							Lmsn	0035	
15	1	5	30	14	21	20	Brwn clay	0010	
							Stns	0012	
							Grey lmsn	0031	
16	2	3	30	6	15	20	Brwn clay	0010	
							Blue clay	0021	
							Brwn lmsn	0032	
17	2	3	27	15	18	20	Brwn clay	0010	
							Blue clay	0019	
							Lmsn	0029	
18	2	3	26	22	25	8	Brwn clay	0022	
							Blue clay bldr	0024	
							Grey lmsn	0036	
19	2	4	30	12	15	5	Clay	0024	
							Lmsn	0032	
20	2	4	36	7	28	2,	Brwn clay	0010	
							Grey clay	0020	
							Grey lmsn	0038	

WELL NO.	LOCATION BLOCK CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL. FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
21	2	4	32	8	15	10	Blue clay	0020	
							Grey lmsn	0033	
22	2	5	20	6	10	15	Clay	0018	
							Lmsn	0020	
23	2	5	26	16	20	13	Clay	0020	
							Lmsn	0028	
24	2	5	40	10	15	30	Tpsl	0006	
							Brwn clay	0020	
							Blue clay	0038	
							Grvl	0042	
25	2	3	28	15	25	10	Brwn clay	0019	
							Blue clay	0026	
							Grey shle	0028	
26	2	3	30	15	20	3	Tpsl	0003	
							Grvl stns	0028	
							Lmsn	0030	
27	2	3	39	8	25	25	Brwn clay	0017	
							Grey clay	0028	
							Grey lmsn	0041	
28	2	3	37	15	30	10	Brwn clay	0010	
							Blue clay stns	0033	
							Lmsn	0038	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
29	2	3	32	15	20	10	Brwn clay	0020	
							Blue clay	0028	
							Blue clay grvl	0030	
							Grey lmsn	0032	
30	2	4	35	10	12	17	Clay	0032	
							Lmsn	0035	
31	2	5	40	25	27	17	Clay	0039	
							Shle	0040	
32	2	5	40	24	25	17	Clay	0039	
							Lmsn	0040	
33	2	5	36	16	17	16	Clay bldr	0035	
							Shle	0036	
34	2	5	22	4	14	10	Clay stns	0014	
							Shle	0017	
							Lmsn	0026	
35	2	5	23	6	14	9	Brwn clay	0014	
							Grey lmsn	0024	
36	2	5	30	7	20	25	Brwn clay	0014	
							Grey clay	0022	
							Grey lmsn	0030	

WELL NO.	LOCATION BLOCK	LOT	WATER FOUND	STATIC WATER LEVEL	PUMP LEVEL	TEST RATE	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER
	CONC		FEET	FEET	FEET	GPM			COMMENTS
37	2	5	20	6	10	17	Clay	0010	
							Grvl	0013	
							Shle	0016	
							Lmsn	0020	
38	2	5	25	10	15	6	Clay	0022	
							Hpan	0023	
							Lmsn	0025	
39	2	5	33	18	18	17	Clay	0018	
							Shle	0019	
							Lmsn	0033	
40	2	5	33	18	20	17	Clay	0017	
							Shle	0018	
							Lmsn	0033	
41	2	5	25	15	25	20	Brwn clay	0020	
							Lmsn	0030	
42	2	5	30	10	20	10	Brwn clay	0008	
							Blue clay	0022	
							Lmsn	0030	
43	2	5	25	12	18	17	Clay	0015	
							Msnd clay grvl	0022	
							Lmsn	0026	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
44	2	5	27	16	18	9	Brwn clay	0017	
							Grey clay	0020	
							Grey lmsn	0028	
45	2	5	19	10	15	13	Clay	0016	
							Lmsn	0021	
46	2	5	38	22	25	10	Brwn clay	0030	
							Blue clay	0038	
							Grey lmsn	0039	
47	2	5	35	18	23	13	Brwn clay	0015	
							Blue clay	0018	
							Blue lay stns	0024	
							Grey lmsn	0036	
48	2	5	22	8	20	10	Brwn clay	0010	
							Blue clay	0022	
49	2	5	23	12	20	10	Clay	0020	
							Lmsn	0024	
50	2	5	31	11	18	10	Brwn clay	0018	
							Blue clay	0023	
							Lmsn	0031	
51	2	5	41	7	26	11	Brwn tpsl	0002	
							Brwn clay	0014	
							Grey clay	0040	Sulphur
							Grey lmsn	0042	Water

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
52	2	5	28	15	25	10	Clay	0018	
							Clay stns	0023	
							Lmsn	0030	
53	2	5	31	11	18	10	Brwn clay	0018	
							Blue clay	0023	
							Lmsn	0031	
54	2	5	23	11	14	13	Brwn tpsl msnd stns	0010	
							Blue clay	0022	
							Grey lmsn	0025	
55	2	5	25	15	15	15	Tpsl	0008	
							Brwn clay	0011	
							Grey clay	0018	
							Rock	0026	
BLOCK II									
56	1	7	30	17	28	15	Brwn tpsl	0001	
							Brwn clay	0016	
							Blue clay bldr	0023	
							Lmsn	0030	
57	1	1	31	19	21	10	Clay	0026	
							Lmsn	0031	

WELL NO.	LOCATION BLOCK	LOCATION LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
58	1	1	29	4	14	25	Tpsl clay	0002	
							Brwn clay stns	0008	
							Grey clay stns	0012	
							Blue clay	0026	
							Blue clay lmsn	0029	
							Grey lmsn	0032	
59	1	1	30	18	18	17	Clay	0028	
							Lmsn	0030	
60	1	1	26	14	16	17	Clay	0021	
							Grvl bldr	0023	
							Lmsn	0026	
61	1	1	15	15	20	3	Brwn clay	0033	
							Lmsn	0034	
62	1	1	31	16	18	17	Clay	0029	
							Lmsn	0031	
63	1	1	24	16	16	17	Clay	0020	
							Lmsn	0029	
64	1	1	23	16	18	8	Clay	0020	
							Lmsn	0023	
65	1	1	32	20	25	10	Brwn clay	0012	
							Blue clay	0021	
							Lmsn	0035	

WELL NO.	LOCATION BLOCK	LOT	WATER FOUND	STATIC WATER LEVEL	PUMP LEVEL	TEST RATE	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER
	CONC		FEET	FEET	FEET	GPM			COMMENTS
66	1	1	35	22	23	15	Blue clay	0031	
			41				Grey shle	0032	
							Lmsn	0041	
67	1	1	38	20	34	25	Brwn clay	0010	
			42				Grey clay	0024	
							Lmsn	0026	
68	1	1	29	15	22	13	Clay	0025	
							Lmsn	0030	
69	1	1	36	10	14	5	Clay	0029	
							Lmsn	0036	
70	1	1	26	10	12	17	Clay	0024	
							Lmsn	0036	
71	1	2	29	7	14	15	Brwn clay	0012	
							Blue clay	0014	
							Brwn lmsn	0031	
72	1	2	27	12	11	10	Brwn clay	0016	
							Grey lmsn	0028	
73	1	2	36	15	18	7	Clay	0017	
							Lmsn	0037	
74	1	2	29	20	20	10	Clay	0024	
							Lmsn	0029	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
75	1	2	24	8	18	10	Clay	0017	
							Lmsn	0026	
76	1	3	38	10	15	10	Blue clay	0022	
							Grey lmsn	0045	
77	1	3	30	15	25	5	Brwn clay	0019	
							Lmsn	0032	
78	1	3	27	10	28	10	Clay	0021	
							Lmsn	0030	
79	2	1	31	15	22	17	Clay	0022	
							Lmsn	0031	
80	2	1	42	16	20	17	Clay	0040	
							Grvl shle	0042	
81	2	1	35	20	32	3	Brwn clay	0010	
							Blue clay	0025	
							Lmsn	0037	
82	2	1	40	18	25	20	Brwn clay	0006	
							Blue clay	0038	
							Shle	0040	
83	2	1	30	12	15	10	Clay	0018	
							Lmsn	0030	

WELL NO.	LOCATION BLOCK I CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
84	2	2	22	8	12	20	Tpsl	0004	
							Brwn clay	0020	
							Grey shle	0022	
							Grey lmsn	0024	
85	2	1	35	16	25	18	Tpsl	0002	35 Fresh
			42				Brwn clay	0012	Water
							Grey clay	0040	42 Sulphur
							Grey lmsn	0042	Water
86	2	1	46	16	30	17	Clay	0044	
							Shle	0046	
87	2	1	45	16	30	20	Brwn clay	0044	Sulphur
							Grvl	0045	Water
88	2	1	44	18	20	17	Clay	0039	Sulphur
							Lmsn	0044	Water
89	2	1	24	18	20	5	Clay	0015	
							Lmsn	0025	
90	2	1	22	16	22	5	Brwn clay	0016	
							Lmsn	0024	
91	2	1	24	10	8	10	Tpsl	0003	
							Brwn clay bdlr	0019	
							Grey grvl	0026	

WELL NO.	LOCATION BLOCK CONC	I LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
92	2	1	43	17	17	17	Clay	0042	
							Shle	0043	
93	2	1	23	10	10	30	Tpsl	0005	
							Blue clay	0018	
							Lmsn	0025	
94	2	1	23	8	13	25	Tpsl	0003	
							Brwn clay	0014	
							Grey shle	0023	
95	2	1	20	10	20	5	Clay	0018	
							Lmsn	0030	
96	2	2	32	8	25	20	Clay	0028	
							Lmsn	0035	
97	2	2	38	15	20	10	Brwn clay	0014	
							Grey lmsn	0039	
98	2	2	28	8	15	5	Brwn clay	0020	
							Lmsn	0028	
99	2	3	21	4	18	8	Brwn clay	0015	
							Lmsn	0021	

APPENDIX E

ALTERNTIVE ON-SITE SYSTEMS

ALTERNATIVE ON-SITE SYSTEMS

In determining whether an area is capable of sustaining future residential development, an important criteria is water consumption. For instance, if water conservation systems such as low water use toilets were employed to reduce water consumption, the required tile field size could be reduced.

Four such toilets have been considered including the "Flush-O-Matic", "Mansfield", "Microphor" and "International Water Saver Toilets Inc.". The Flush-O-Matic only uses about 1 quart of water for each flush. However, this toilet does not have a trap and as such does not meet the Ontario Plumbing Code regulations for installation in a residence. The Mansfield toilet requires 3 quarts per flush. However, we have been advised the unit has not proved to be reliable and plumbing suppliers are hesitant to market the unit. The Microphor toilet requires an auxillary air supply from a small air compressor. Only 3 quarts of water are required for each flush. However, due to the need to install an air compressor in each residence and the lack of a trap that meets the Ontario Plumbing code, we have rejected this unit. The International Water Saver Toilets Inc. toilet operates on a pre-charged air pressure tank and in this way it is possible to use only one gallon per flush. This particular toilet has just been introduced and will shortly be tested in a new development in Waterloo.

A. Reduction in Water Consumption

Changes to the shower heads, use of aerators on the nozzle of all taps, purchase of sud saver type washing machines cannot be legislated or reasonably controlled. Accordingly, it must be concluded that the only satisfactory changes are those which the occupant cannot interfere with. Components such as pressure reducing valves on the service connection and possibly the installation of a pre-charged pressure tank type toilet woud seem to offer the best chance of long term success with an overall water saving of 10 to 15 pgcd. This amount may appear to be small, but can significantly reduce the size and cost of the sewage disposal system.

B. Individual Private Sewage Disposal Systems

A number of individual private systems are available and could be considered in comparison to the standard septic tank and tile field.

(i) Class 6 Systems

A proprietory type plant that includes an effluent sand filter that will effluent discharge to a raised tile field would be considered as a Class 6 system.

These plants require regular attention by a skilled operator as the plant relies on both the maintenance of a biological system for the degradation of organics and a filter for the removal of most of the suspended solids before being discharged to the tile field. The plant process is identical to most municipal plants that is many times larger than the household unit, daily operator attention is required to maintain a suitable environment for the varied cultures of micro-organisms. Because of this operational need, generally the biological portion of the household plant does not function well except to the extent that the sewage is aerated. Accordingly, depending on the useful life of the sand filter the effluent discharged to the tile field will have most of the solids removed.

(ii) Raised Tile Field

A number of variations exist concerning the construction of the tile field to receive the effluent from a standard septic tank or other treatment facility. The field can be constructed to achieve partial disposal of the sewage by percolation into the native soil, storage of the effluent during the late Fall, Winter and early Spring and evapotranspiration during the grass growing season.

(ii) Raised Tile Field (con't)

A raised field can be a suitable alternative in soils having a permeability greater than 10^{-5} cm/sec as the native soils are adequate to achieve percolation of the sewage into the ground. Also, in areas where there is a high water table, a raised tile field can increase the distance between the distribution tiles and the water table. A raised tile field is normally not as effective for effluent disposal as the opportunity for percolation in the horizontal direction is reduced. Accordingly, a greater amount of care is required in the construction of the raised field through deep ploughing of the underlying native soils. Also, it would be necessary to ensure that the sewage has been adequately treated before it reaches the native soils to ensure that a micro-biological growth build-up on the soil particularly does not occur which would inhibit the percolation process.

(iii) Pressurized Tile Fields

Some success has been achieved in clay type low premeable soils where tile field systems have failed through the use of a pressurized tile field system. In one instance in North Carolina, an existing housing development with relatively small lots has almost 100% failure of the standard tile field as evidenced through effluent ponding on the ground surface. The community was served with a communal water supply.

An experimental tile field was constructed. Perforated plastic piping 1 1/2 inches to 2 inches in diameter was installed in trenches with an 18-inch spacing throughout the entire yard. The piping was placed level at about 1.5 feet below ground surface. Native backfill was replaced in the trench with no sand or gravel

(iii) Pressurized Tile Fields (con't)

being used. A small pump well was constructed to receive the effluent from the septic tank and pump it into the tile field. The tile field layout was designed so that a pipe from the far end of the field would return excess sewage flows to the pump well. A pressure reducing valve set at 2 to 3 psi maintained a backpressure on the tile field. The tile runs were in the order of 2,000 linear feet. This system reportedly has worked well and ponding is no longer a problem. On examination of the system, it appears that with the small tile run spacing and the use of native materials as the backfill, that the system has achieved equal distribution of the septic tank effluent over the entire field area.

Also, with the warm water weather that prevails in North Carolina the sewage is being removed by evapotranspiration almost all year round. For this reason, this type of system would not be feasible at our latitude.

(iv) Compost Toilet

Some European countries utilize composting toilets for disposal of the "black" water. The "grey" water is treated separately in a septic tank and tile field. A composting toilet has the advantage that no water is used and the per capita water consumption for other domestic uses is reduced to about 25 gpcd. The composting toilet requires normally that the washroom be located on an outside wall of the house and on the first floor. The toilet and composting tank are an integral unit and the compost is removed for land disposal every few months. There have been many operational difficulties with these toilets and it has been necessary to install heating elements to evaporate off the excess amounts of water. This evaporation process would be expected to produce objectionable odors and is considered to be wasteful of electrical energy.

(v) Incineration

The "Incinolet" toilet has been available in Ontario for a number of years. All wastes are electrically incinerated as an ash. The unit will function provided it is not overloaded as when this happens the heating element is insufficient to achieve rapid burning of the waste.

All water is released as steam. Due to the necessary drying of the waste before incineration can take place these units have created objectionable odors. These units would not be recommended for installation.

(vi) Reuse System

A number of experimental plants have been installed in the U.S. to receive all sewage from a single household into a Class 6 type plant.

In one test, the effluent after filtration was disinfected with iodine and used in a greenhouse. The pea gravel filter produced an effluent BOD and suspended solids of 3 ppm. It was claimed that the water after having been filtered in a charcoal filter could be re-cycled to flush toilets and for lawn watering. However, it is still necessary to discharge a portion of the effluent from the greenhouse irrigation system. This system apparently functioned well. The plant construction cost is about $7,000 U.S. (1979) and to this must be added the greenhouse cost. Because the effluent is well treated and after being used as irrigation water, it would be expected that the BOD would be very low and that the nutrients would be effectively removed.

(vi) Reuse System (con't)

However, we would be concerned about the continued effective operation of such a system installed to serve each premise. Also, it would not be practical to construct a plant and greenhouse for each building or group of buildings. In addition, the greenhouse would have to be heated during the winter as solar heat would not be adequate.

The Thetford Corporation is now marketing a reuse plant under the name "Cycle-Let" and now has a number of installations at service stations and industrial plants. The plant provides biological treatment, settling, ultra filter membrane filtrations and activated carbon absorption with ultra violet or ozone disinfection. The plant, to date, has been used for the recycle of water to toilets. In all instances low water use type toilets have been employed. The cost of this plant is quite high at $40,000 U.S. (1979) to treat approximately 100 gpd. Due to the high cost we would not recommend this plant unless the cost of alternative systems was greater.

(vii) Recycle System

The Pure Cycle Corporation in Boulder Colorado has a recycle plant. The treatment unit includes a rotating biological contactor followed by settling and filtration through ultra filter membranes, activated carbon absorption, cation and anion exchange and disinfection with ultra violet light. The plant is precharged with approximately 1,200 gallons of water and after treatment is stored in a clean water holding tank. The water is used for all domestic needs and reportedly meets all standards respecting water purity requirements.

(vii) Recycle System (con't)

It is necessary that the process be complete recycle, as the treatment plant deionizing system is capable of removing only a fixed amount of chemicals each day. No information is available respecting virus removal. The plant cost is $10,000 U.S. (1979) plus a monthly service charge of $30.00. To this must be added the cost of electricity to operate the plant which would be approximately $12.00 per month.

Assuming the plant does meet all requirements for full recycle social acceptance may be difficult to achieve.

(viii) Holding Tank

A holding tank could be installed for each building or group of buildings with the contents being trucked to one of the Region's sewage treatment plants. Due to the excessive haulage cost that would result if this method of disposal were adopted, this alternative would only be recommended if the majority of buildings could be served with an on-site disposal system and a holding tank was required for a very small number of existing buildings.

APPENDIX 'F'

FIGURE 1

5
2
1st CONCESSION ROAD
2
GOLF CLUB ROAD
5
0-10%
(WOODBURN ROAD)
0-10%
5
2
2
CREEK

REPRESENTATIVE
20 HECTARE
PARCEL

REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
PLANNING AND DEVELOPMENT DEPARTMENT
OFFICIAL PLAN DIVISION

SETTLEMENT CAPABILITY STUDY

WOODBURN

FIGURE I

LEGEND

STUDY AREA BOUNDARY

TERRAIN CLASSIFICATIONS

SLOPE

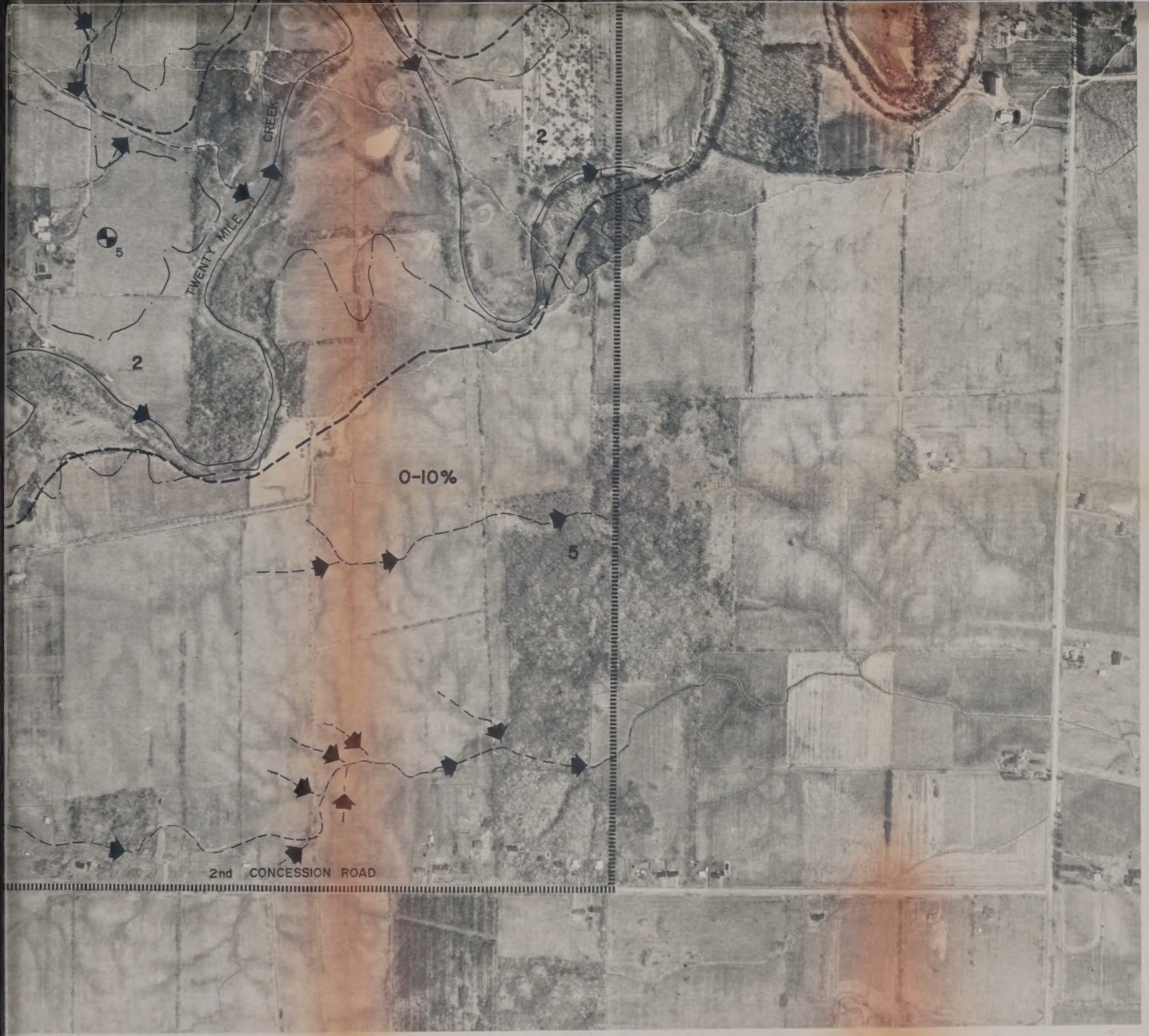
AREA BOUNDARY

GRADE PERCENTAGE

0-10%

DRAINAGE


2
3
REGIONAL ROAD 34
5
TWENTY MILE CREEK
2
TWENTY MILE CREEK
2
0-10%
5
(DRAFT) REGIONAL FLOODLINE
5
0-10%
5
2nd CONCESSION ROAD



NOTE: THIS MAP WAS COMPILED FROM AERIAL PHOTOGRAPHY AND SHOULD NOT BE SCALED.
THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE WRITTEN TEXT.

SLOPE

AREA BOUNDARY

GRADE PERCENTAGE — 0-10%

DRAINAGE

CONTINUOUS

INTERMITTENT

SOILS

AREA BOUNDARY

TEST HOLE SITES — 3

CLAYS — 2

CLAY TILLS — 5

Underwood McLellan Ltd. the uma group

DRAWN BY: S.W. LEONARDI	SCALE= 1:4800 (approx.)	PROJECT NO. 1931-020-00-21
CHECKED BY: D.M. BROWN	0 2400 4800 7200 9600 12000	PLAN NO.
APPROVED BY: K. REICHERT	DATE: AUGUST / 1980	